경영학 석사학위논문

Turnover and Innovation: Moderating Effect of Skill Type, Skill Level and Communication

이직과 혁신의 관계: 기술 종류, 기술 수준과 커뮤니케이션의 조절 효과

2017년 8월

서울대학교 대학원
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ABSTRACT

Turnover and Innovation: Moderating Effect of Skill Type, Skill Level and Communication

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Main focus of this study tries link the connection between turnover and innovation. Despite the thorough researches regarding both turnover and innovation there has been a lack of interest between these two. Drawing from both human capital and social capital theory here it predicts that turnover will have a negative impact on a firm's innovative performance. There has been a growing importance of whose turnover has a stronger impact on organizational performance. Some researchers have focused on the difference of individual's performance levels but to measure individual's contribution to a firm's innovation, how much knowledge an individual has is important. Organizational tenure has been known to be a good

measure of an individual's stock of knowledge and experience, so for the current study it focuses on the differences in individual's tenure. It also tries to discover what contextual factors within an organization may strengthen or lessen the relationship between turnover and innovation. A total sample of 210 Korean firms were used to the proposed hypotheses by negative binomial regression. Results show that there is a negative relationship between turnover and innovation, but also shows that turnover maybe beneficial for innovation if there is either a low or high rate of turnover within the organization. Furthermore, the level of skill and communication have shown to moderate the negative relationship, showing that contextual variables within organizations should be also considered for future researches. This study is one of the few study that tries to connect the link turnover and innovation and also highlights that consideration of contextual variables are needed.

Keywords: Turnover, Innovation, Human Capital, Social Capital, Organizational Tenure

Student number: 2015-20670

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I. Introduction

Turnover is still an important subject in the business environment due to the fact that the occurrence of turnover can affect a firm's performance (Hinkin & Tracey, 2000). Every organization faces such problems and studies regarding how HR policies and practices can reduce turnover have received much attention (Griffeth, Hom, & Gaertner, 2000; Shaw, Delery, Jenkins, & Gupta, 1998). Trying to understand what causes individuals to turnover can help organizations to plan ahead in order to stop it from occurring or to try and minimize the consequences when a turnover should occur, which allows organizations to reduce the negative consequences of it (Felps et al., 2009; Mossholder, Settoon, & Henagan, 2005). There have been diverse studies such as how an individual's personality (Barrick & Mount, 1996), relational processes(Mossholder et al., 2005) stressful events can affect an employee's decision of turnover(Podsakoff, LePine, & LePine, 2007) as well as its effects on firm performance levels(Kwon & Rupp, 2013).

Yet despite such researches regarding turnover researchers have mainly focused on examining antecedents and consequences such as productivity and efficiency (Kacmar, Andrews, Van Rooy, Steilberg, & Cerrone, 2006; Shaw, Duffy, Johnson, & Lockhart, 2005) and usually has been considered to be quite a troublesome issue(March & Simon, 1958). Nowadays for organizations innovation has become an important performance predictor because not only does innovation

affect their performance levels but also play an important role for their survival in the long run (Hamel, 2006). Despite the growing importance of innovation level for organization there have been very few researches trying to link the connection between turnover and innovation (Cohen & Klepper, 1996; Ettlie, 1985; Guidice, Thompson Heames, & Wang, 2009). Despite the continuously growing interest in the creativity and innovation literature(Anderson, Potočnik, & Zhou, 2014) the question of how turnover might influence innovation has not received much attention. Not only has there been a lack of interest in the connection between turnover and innovation, there has been a lack of interest between HR practices and innovation as well (Laursen & Foss, 2003).

Although it may depend on the situation an organization is at, normally turnover is undesirable in organizations because not only does it cost the organization but it also results in loss of the capital and knowledge an individual possess (Darmon, 1990; Dess & Shaw, 2001). To avoid such negative outcomes researchers have tried to understand the antecedents, processes of turnover and tried to discover on employee retention (Lee & Sung, 2005; Steel & Lounsbury, 2009).

A turnover of any individual within an organization results in all forms of capital, so it is likely that for firms to be innovative an ideal level of turnover should be maintained inside the organization. But researches have shown that individuals

do not withhold the same level of capital and that firms focus on workers with higher level of capital (Oldroyd & Morris, 2012; Slan-Jerusalim & Hausdorf, 2007). It is mainly due to the fact the current business environment is in knowledge economy making high performers or star employees more important (Aguinis & O'Boyle, 2014). Also an individual's organizational tenure is positively related to work experience (Ng & Feldman, 2010), allowing them to have higher level of job-related knowledge (Myers, Griffith, Daugherty, & Lusch, 2004). It is undeniable that such employees with high level of human capital in some cases individuals who are considered as a star is important for innovation, but there is also a need to study those employees who are not considered as such (Malik & Singh, 2014). Employees who are high in potential or who is a star such as Bill Gates of Microsoft or Howard Schultz of Starbucks are important it doesn't mean that the other employee's contribution to their respective company should be ignored.

In this paper there will be three main objectives that will be investigated regarding the relationship between turnover and innovation. First and primary question is to find the linkage between turnover and innovation. As mentioned by Guidice et al. (2009) there has been very few researches trying to connect the dots between the two. Among the few researches they have studied on the relationship between HRM practices as a whole and innovation(Eriksson, Qin, & Wang, 2014; Michie & Sheehan, 2003). By examining the relationship between turnover and

innovation it will broaden the area of research regarding the consequences of turnover.

Second objective of the current paper is to examine the effects of the turnover on innovation by separating the workers into different groups based on their tenure inside the organization. One group will consist of high tenure within their companies, which can be considered as employees with higher stock level of knowledge, while the other group will consist of lower tenure, which can be considered as employees with lesser stock of knowledge. Kulik and Ambrose (1992) mention that to identify influential employees in the company it would be better to look at their tenure. Also the longer an individual stays inside the organization they gain greater knowledge within firms (Gavin & Greenhaus, 1976). So by dividing the employees into two groups who are more influential or not to the company it would be possibly to see whether there is a big difference between employees in their contribution to the company.

Lastly it is to view what could possibly weaken the possible negative impact of turnover on the organization. Even in meta-analysis or a general review paper the main focus is about the antecedents and financial consequences of turnover (Griffeth et al., 2000; Hancock, Allen, Bosco, McDaniel, & Pierce, 2013; Holtom, Mitchell, Lee, & Eberly, 2008). There is a lack of research regarding what

organizations can do to reduce the negative effect of turnover. By discussing about what could nullify such effects would provide additional information for HR departments on what they could do to reduce the possible negative impacts of turnover on their organization.

To summarize by this study hopes to provide both theoretical and empirical findings regarding the relationship between turnover and innovation. Also by trying to discover what factors inside an organization moderates those two factors could provide a practical meaning for firms. In the following sections I will first provide a brief review of turnover and innovation and then will present the conceptual model of the paper.

II. Literature Review and Hypothesis

1. Innovation literature

Innovation is becoming important and is now one of the key determinants of an organization's performance, due to its importance it has been approached from diverse levels(Anderson, De Dreu, & Nijstad, 2004; Anderson et al., 2014; Hülsheger, Anderson, & Salgado, 2009). There are diverse perspectives in the creativity and innovation literature and the term's definition differs slightly depending on a researcher's viewpoint. Despite so a common definition of 'creativity' is generation of new and novel ideas, while 'innovation' is the actual implementation of those creative ideas. In order to view how well a firm's innovation is researches have used product or process innovations as dependent variables for their respective study (Laursen & Foss, 2003; Michie & Sheehan, 2003).

Despite the growing importance of innovation there has been a lack of interest about how HR practices and mechanisms affect innovation until recently (Shipton, West, Dawson, Birdi, & Patterson, 2006). Other organizational level researches regarding the innovation literature has focused on human resource practices(Martínez-Sánchez, Vela-Jiménez, Pérez-Pérez, & de-Luis-Carnicer, 2011; Shipton et al., 2006). Since then there have been different approaches to the

organizational level of innovation such as HR's pay structure (Beugelsdijk, 2008), management support (Choi & Chang, 2009) and knowledge utilization. Yet there has been relatively few researches dealing with HRM or any function of HR to innovation (Guidice et al., 2009; Michie & Sheehan, 2003).

2. Turnover literature

Topic of turnover has received much attention even from the 1900s and March and Simon (1958) presented the "pull and push" model, which explains the forces that affect turnover. Since then researches have built on their model from an individual level of analysis to contextual variables focusing on antecedents such as satisfaction and commitment (Pfeffer, 1985). Researches regarding on the overall antecedents of turnover can be viewed in Holtom et al. (2008)'s paper.

In order to prevent turnover it is crucial to understand what causes it happen but understanding its consequences is also important. By understanding the results of turnover that should occur within the organization can help them to avoid high rates of voluntary turnover which has proven to be harmful (Glebbeek & Bax, 2004). Researchers have tried to answer the actual consequences of turnover such as a firm's performance by viewing at ROA(return on assets), ROE(return on equity) (Kwon & Rupp, 2013). There has been a clear negative relationship between

turnover and such outcomes but the mechanism that causes it has been a question in the literature. Although generally a turnover has a negative influence for the organization in some specific cases of turnover such as poor performers it can rather be beneficial and researchers have tried to distinguish voluntary and involuntary turnover (Holtom et al., 2008).

There are several perspectives on why turnover is expected to be related to a negative organizational performance. Before the 2000s there were mainly two perspective: ‘Cost or cost benefit approach’ and ‘human capital theory’(Darmon, 1990; Strober, 1990). The cost benefit approach is the cost that arises within an organization when a turnover occurs. Mainly there are the two costs that occur due to an employee turnover. One is separation cost which is the cost when organizations separate or layoff their employees. The other cost arises from hiring and training a new employee to make up for the loss of personnel.

Human capital theory centers on that the essential of a firm’s productivity exists within the ability and skills of an organization’s human resources (Strober, 1990). For firms to be productive it is important for organizations to acquire and maintain their human capital, which is their employee. In this view turnover of any personnel would mean the loss of human capital for the firm which will affect the firm’s overall performance (Batt, 2002).

Another perspective trying to explain the negative consequences is the social capital suggested by Dess and Shaw (2001). (Dess and Shaw (2001); Leana and Van Buren (1999)) view social capital as a public resource that is created within the organization through the socialization between members of the organization. Through this process tacit knowledge-based resources are created making it valuable in the knowledge based business world (Aguinis & O'Boyle, 2014). If a turnover should occur such social capital would be lost and would lead to having a negative impact on a firm's performance. Based on the previous theoretical perspectives it has already been repeatedly explained on why turnover would have a negative impact on organizational outcomes. Since turnover causes costs and losses in both human and social capital it can be also hypothesized as thus:

Hypothesis 1: Turnover will have a negative relationship with a firm's innovative performance.

3. Organizational Tenure

Turnover's negative influence on firm's performance has been both theoretically and empirically tested (Batt, 2002; Huselid, 1995). Researchers have started to question which member of employee's turnover would be more serious (Barrick & Zimmerman, 2005). Changes in the business environment to a

knowledge-based one have made star performers or employees with knowledge valuable (Aguinis & O'Boyle, 2014). That has made researchers to focus on how star performers, high performers or employees with high level of knowledge's turnover would affect the firm's and the individual's performance levels (Groysberg & Lee, 2009; Groysberg, Lee, & Nanda, 2008; Kwon & Rupp, 2013).

It has been researched that star performers or high performers would have better human and social capital within them. So it has been acknowledged by scholars that naturally high performer's turnover would be critical for the organization. Yet there are also calls that employees who do not fall in to such category also need consideration(Malik & Singh, 2014). Malik and Singh (2014) calls them the 'B players' discussing about how they should be considered in order to improve the firm performance even up to a higher level. Given enough training and time to acquire the knowledge for their daily work even for employees who are not considered at a high-esteem has been shown to be more effective(Ployhart, Van Iddekinge, & MacKenzie, 2011). This shows that the so called 'B-players' if trained well enough can also effectively perform well inside the organization up to a certain level compared with the 'A-players'.

Dividing a firm's human resources into either a high or low performer is one way when trying to assess an organization's performance. A different way that

can be divided is by an individual's organizational tenure and has been examined whether tenure influences an organization's productivity (Ng & Feldman, 2008). Higher levels of tenure within an organization has been shown to raise performances(Judge, 1994). Organizational tenure is often used as indicator of work experience and leads to higher work skills and knowledge and can be considered as having a high level of human and social capital within the firm. When using productivity or financial outcomes as the dependent variable it has been shown that long-tenure workers contribution becomes lesser compared to others. However innovation is a different measure to other outcomes and has been shown that long-tenure workers can contribute to innovation better in some cases (Ng & Feldman, 2013).

Instead of merely focusing on the high performers or employees with high tenure inside the organizations it would also be important to take a closer look at the influence of the other worker's contribution to the organization. Every employee has their own level of human and social capital even though the level will vary quite differently between individuals. Nevertheless both groups of employees contribute to the organization's outcome in their own respective ways. By testing whose turnover impacts more on a firm's innovation it will allow organizations to whether to maintain their HR practices as they have been or to change when they discover a certain level of tenure should be more influential to innovation.

Hypothesis 2: Strength of the relationship between turnover and innovation will depend on the tenure of the individuals who turnover. Turnover of individuals with long-tenure will have a stronger relationship with a firm's innovative performance compared to the turnover of individuals with short-tenure.

4. Organization's contextual factors: Skill level, Skill type, Communication

Researches have mostly have been focused on the antecedents or the outcome of turnover, which can be seen from Holtom et al. (2008)'s model of previous turnover research. Even with deeper understandings of predictors and consequences of turnover there has been scant attention towards contextual variables that could either enhance or lessen the effect. Kwon and Rupp (2013) also points out the little attention paid in the literature and tries to view how human capital investment and firm reputation might affect the effect of turnover. Which and how contextual variables in organizations strengthen or weaken the negative impact of turnover has yet to receive attention from scholars. I have predicted in the above hypothesis that it is most likely the turnover of long-tenure employees will have a stronger negative influence on a firm's innovative performance, because through their job experiences they would have accumulated more human and social capital. If turnover leads to all kinds of losses for organizations than the question that needs to be answered is there anyway a firm can minimize their losses. Loss of

either human or social capital has shown to be critical for organization's productivity and financial performances. Ployhart et al. (2011) has shown that an individual's human capital can be added up into unit-human capital, making the organization stronger even when a turnover should occur. So to minimize their loss of human capital organizations should look toward contextual factors such as HR practices being used.

It would be possible for firms to minimize their losses if their employees in the organization would not be affected by the capital and knowledge loss caused by the turnover. Such things would depend on the skill acquired and used inside the organization. Depending on whether the skills were more firm-specific or general the loss of knowledge due to a turnover may or may not be so devastating. Transferability of knowledge differs on the characteristics it holds. For example as explained by Nonaka (1994) tacit knowledge which is abstract is more difficult to be transferred compared to explicit knowledge which is codified and easy to be transferred. Likewise firm-specific skills are comparatively difficult to transfer to others because it requires much more investment and efforts from the organization (Wang, He, & Mahoney, 2009). Therefore, depending on the skills used inside an organization the transferability of knowledge an individual holds will be different. So even if same rates of turnover should occur within an organization the consequences each firm may differ. Depending on the skills that is commonly used

by employee's turnover may or may not have a critical impact on innovation. If skills that are generally used are more firm-specific instead of general than it would be difficult for employees to cover the losses caused by turnover. On the other hand if a turnover should occur in an environment where general skills are more used than the loss of knowledge caused by turnover might not be so critical as expected.

Hypothesis 3a: Depending on the skills used among employees inside the organization will moderate the relationship between turnover and firm's innovative performance. If the usage of skills is more general rather than firm-specific the negative relationship will weaken.

Other contextual factors besides the type of skills that can be considered would be the skill level of the employees inside the organization. Inside an organization there would be a variety of tasks and each individual's task maybe different with each other. Every individual has their own set of knowledge, skill and abilities(Strober, 1990) but an organization's human resource capital can be measured by aggregation of the individual's human capital level.

Depending on the average skill level of employees, the losses of capital caused by turnover may or may be difficult to fill in. If an organization has managed their human resource capabilities high enough than the problems caused by turnover may not be so significant, but otherwise for the opposite case. Also if the general

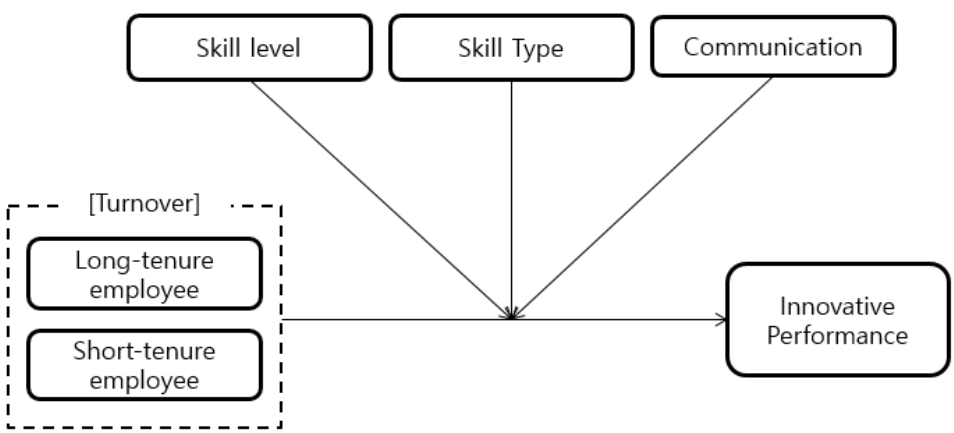
level of skill level is high within organizations the knowledge can be easily acquired from the individuals who decide to turnover. So consideration of an organization's employee's skill level can influence the relationship between turnover and innovation and can be hypothesized as follows:

Hypothesis 3b: Depending on the overall employee's skill level inside the organization will moderate the relationship between turnover and firm's innovative performance. If employees are more skilled individually the negative relationship will weaken.

For employees to understand and have high skill level within the workplace it is crucial that communication occurs at a higher level. Having higher communication level ensures that important information inside organization is shared among employees. Even with high communication levels the knowledge withheld by individuals may be difficult to be transferred. For the type of knowledge being transferred also needs to be considered for some types of knowledge are difficult to transfer without a full support from the organization(Wang et al., 2009). By being aware of their organization's goal and being informed helps employees to having high proficiency in their areas of work. In addition by communicating with others it allows employees to interact with each other, which leads to creating social capital or acquire knowledge, skills that they

did not have. Communication provides diverse information and knowledge, which promotes efficiency within the organization(Anderson et al., 2004). By being more aware of their organization's process will make employees knowledgeable in other sections outside of their own section, which would allow them to fill in someone else's gap if it should appear. Also it will allow individuals to share knowledge with each other and raise the firm's overall human and social capital levels and lessen the impact of turnover on innovation. In the following page the model of the current paper is presented in figure 1.

Hypothesis 3c: Depending on the organization's communication level inside the organization will moderate the relationship between turnover and firm's innovative performance. If there is a higher level of communication the negative relationship will weaken.



<Figure 1>

III. Methodology

1. Data and Sample

This study intends to use the number of patents to measure an organization's innovative performance level. Number of patents registered is a count data and among the fixed-effects model that can be used is either a Poisson regression model (Palmgren, 1981) or negative binomial regression model (Allison & Waterman, 2002). An important aspect of Poisson regression model is that a model's mean equals its variance. If the model's variance should not equal its mean and be greater than it, it is known as an over dispersion making it inappropriate to use Poisson regression model (Berk & MacDonald, 2008). When Poisson regression is used when there is an over dispersion in the model goodness of fit will be decreased (Gurmu, 1991). Since the outcome variable of the data being used is a count data, which has multiple value and has no upper bound usage of negative binomial regression will be appropriate for the current study.

To test the model above I will be drawing data from HCCP (Human Capital Corporate Panel) that is provided by KRIVET (Korea Research Institute for Vocational Education and Training). HCCP has been collecting data for every 2 years which started since 2005. Data collection basis for HCCP data is performed at the firm level and their main objective is to help Korean corporations to maintain

and enhance their knowledge and skills of each corporation's HR level. The basic level of analysis is performed at the corporate unit level and is supplemented by analysis that comes from the worker working inside the corporation that is being surveyed. It also provides additional corporate performance data through both financial and patent data.

Among the HCCP data collected the 5th data collected in 2013 was used to test the hypothesis presented above. In the 2013 survey a total of 482 firms and 10,043 employees participated to answer the survey presented by KRIVET. Among the survey data firms were asked about their human resource system in general, which includes an overview of the firm itself, workforce information, human resource development plans and human resource management plans. While also the survey for employees was conducted alongside with the firms to understand impact of the firm's human resource management and development efforts. To measure the relationship between turnover and a firm's innovative performance measurement was done through turnover rate and patent data that could be collected from the dataset. Analysis was performed at a firm level and in order to test the moderating variables presented in the current paper a firm's skill level of employees within firm, type of skill used within a firm and communication level was aggregated from the survey answered by the employees.

Despite the importance of innovation as a performance factor for organizations depending on a firm's industry sector it may not be so important. HCCP sample has all types of industry ranging from manufacturing, financial and other types of industry. To test the innovative performance of a firm data I excluded industries that had no relationship with patent such as financial industry sector. Also I limited the data to firms who had their own research and development lab, which means that each company is putting some effort into R&D sector and is relevant to innovative performance in firms. By doing so the hypothesis testing was done with a total of 210 firms, but due to missing variables the final analysis was conducted with 201 firms. Firms were all manufacturing companies with their R&D lab and had applied for more than once from the time they were established and 62.4% were privately managed by owners. The firm size ranged from 50 employees to 17,147employees and the median firm and the average number of employee has 774 employees.

2. Measures

Independent Variable

Turnover. Data for the level of turnover for each firm was measured by dividing the number of employees who had left to the number of employees within a firm, which were limited to permanent full-time employees only. Measuring turnover rate by dividing number of employees who left to the number of total number of employees in that period is widely used and can be found in earlier researches (Shaw, Gupta, & Delery, 2005; Ton & Huckman, 2008).

In the study voluntary turnover is should be assessed, but the survey doesn't explicitly mention whether turnover was either voluntary or non-voluntary. However it should be considered that in Korea there are strict employment laws in place which makes it organizations difficult to fire employees (Bae & Lawler, 2000). Some turnover was due to regular age limits and such turnover was excluded from the study. It is difficult to rule out all involuntary turnovers that could possibly exist for the turnover measurement but is quite unlikely in this context. To ensure that turnover was a voluntary turnover instead of involuntary turnover additional control variables were added as well.

To compare the turnover rates between high tenure employees and low tenure employees the data was drawn from the questionnaire asking how long did

the employees worked in the current firm before leaving. Although I first hypothesized to compare between high tenure and low tenure employees, the data provided was divided into three categories: 1) Less than one year of employment before turnover 2) More than one year but less than 10 years of employment before turnover 3) More than ten years of employment before turnover. Given these three categories each turnover rate was calculated the same way turnover rate was and then tested to see which employee's turnover should affect a firm's innovative performance.

Dependent Variable

Innovation. To measure a firm's innovative performance it was measure by the number of patents acquired that was provided. Usage of patent data has been shown to be have a high correlation with R&D and has been a common way to measure a firm's innovative performance (Bottazzi & Peri, 2003; Griliches, 1990). Also usage of patent allows researchers to allows researchers to collect data relatively easy and be free from measurement issues that could arise from other measures of innovation (Archibugi, 1988). In order to view the effects of turnover on a firm's innovation the number of patents acquired in 2013 was used. For the 5th survey conducted by HCCP was based on the end of 2012 and to see its effect it

would be more appropriate to view a firm's performance not in the same year but afterwards.

Moderating Variable

Skill type. Skill type was also collected from the supplementary survey directed towards employees. To measure the type of skill used within firms I used the questionnaire that asks employee about whether the type of skill and knowledge used in the current organization is whether generally used across all firms or not. I recoded the data to either firm specific skills or general skills depending on the answer. If answered 'Skill and knowledge acquired and used is useful only in the current organization' I coded as '1=firm-specific' for firm-specific skill, while for answer 'Skill and knowledge acquired and used useful in all places' I coded it as '1=general' for general skill variable. After coding each individual's answer it was also aggregated to see its moderating effect on turnover and innovation.

Employee's skill level. To measure an organizational employee's skill level data was collected from main survey. Ratio of individual's with at least a master's degree or above from the total number of regular employees was calculated. Sample was limited to companies with R&D laboratories so the number of intellect individuals can be used to measure the general employee skill level within the

organization.

Communication. Measurement of the communication levels inside an organization I aggregated the individual's responses to the survey. In the section asking about how employees perceive their communication status there were three questions: 'Our firm communicates with its employees very well and provides information very thoroughly', 'In our firm it is easy to communicate with one's superior', 'Our firm communicates well between departments'. To view an overall level of communication within an organization I only used the first questionnaire for the current analysis.

Control Variable

I controlled several variables to ensure that independent and dependent variables will not be confounded. Firm size is measured by the logarithm of firm sales, which has been suggested that it is also possible to use sales over the number of employees at a R&D relationship(Cohen & Klepper, 1996; Lee & Sung, 2005). Firm age was measured as the number of years from the point of the survey to the foundation date of the firm. Sample firms were all manufacturing companies, so instead of controlling for industry types I controlled for the average turnover rate of each sections of manufacturing sector. Each manufacturing industry turnover rate

was averaged to ensure that a turnover rate in a certain company in that sector did not have an irregularly high turnover rate. Management system was sorted into either the firm operated by a CEO management system or a complete owner system. Market strategy was codified into either 'cost-leadership strategy' or 'differentiation strategy'. Return on asset (ROA), return on equity (ROE) and downsize was controlled to ensure that the turnover that occurred within an organization was voluntary turnover rather than a forced involuntary turnover. Downsize was calculated by comparing the changes in employee size between 2011 and 2013 survey conducted. If firm size was reduced to more than five percent than it was coded into '1=yes/ 0=no'. Percentage of employees who had either a masters or doctoral degree was controlled by dividing the number of the employees with such degrees to the total number of employee. Firms that are trying to innovate and having their R&D lab usually require higher levels of education and was controlled. Hire rate of an organization was measured by the employment number of full-time employees to the total number of employee.

IV. Results

Table 1 shows means, standard deviations and correlations among all the variables used in the analysis. Tables 2 through 6 each tested the hypothesis using the negative binomial regression. Alongside the control variables entered to test the relationship between turnover and innovation, squared turnover rate was also used to check for any curvilinear relationships. It showed that turnover rates ($\beta = -13.686$) was statistically significant, while also square turnover rate ($\beta = 104.044$, $\rho < .05$) was significant. So hypothesis 1 was supported and showed signs of a curvilinear relationship.

In Table 3 and 4 I tested whether difference in individual's tenure of turnover would affect firm's innovative performance. It showed that individuals with a tenure between 1 to 10 year who left the organization showed statistically significant results for both turnover ($\beta = -13.884$, $\rho < .05$) and square turnover rate ($\beta = 159.985$, $\rho < .05$), which also showed that there is a curvilinear relationship like the result of hypothesis 1. For individuals with more than 10 years of tenure it showed that turnover rate was insignificant while square turnover rate ($\beta = -913.671$, $\rho < .05$) was significant. To confirm whether hypothesis 2 was supported or not graphs were drawn which can be seen in figures 3 and 4. To test if moderating variables had an interaction effect on turnover and innovation, moderating variables were multiplied with turnover rates and then tested. Table 5 and 6 each tested if

there was a moderation effect on the relationship between turnover and innovation. There was no significant relationship with either firm-specific or general skill type, not supporting hypothesis 3a. For interaction effects of R&D skill level ($\beta = 61.021$, $\rho < .01$) and communication ($\beta = -18.550$, $\rho < .01$) showed significant results. Thus hypothesis 3b and 3c were supported and to see how each contextual variable moderated the main relationship it can be seen from figures 5 and 6.

Table 1. Means, Standard Deviations, and Correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Firm sales	18.99	1.42	-																			
2. Firm age	35.45	17.31	.095	-																		
3. CEO	.38	.49	.323**	.020	-																	
4. Union	.49	.50	.391**	.380**	.248**	-																
5. Cost strategy	.25	.44	.005	.018	.001	.050	-															
6. ROA	.03	.08	.123	-.078	-.204**	.000	-.113	-														
7. ROE	.06	.29	.062	-.072	-.074	.015	-.124	.651**	-													
8. Downsize	.24	.43	-.187**	.116	.024	-.110	.112	-.221**	-.133	-												
9. MA/PHD rate	.05	.07	-.016	-.019	.032	-.094	-.108	-.237**	-.154*	-.065	-											
10. Hire rate	.14	.12	-.151*	-.220**	-.169*	-.329**	-.035	.103	.095	-.049	-.030	-										
11. Square turnover rate	.01	.01	-.160*	-.041	-.052	-.262**	.115	-.325**	-.249**	.252**	.104	.124	-									
12. Turnover rate	.06	.06	-.189**	-.008	-.078	-.291**	.042	-.304**	-.212**	.204**	.111	.209**	.936**	-								
13. Square turnover rate 1-10 year	.003	.006	-.150*	-.111	-.004	-.300**	.130	-.285**	-.234**	.199**	.160**	.086	.862**	.796**	-							
14. Turnover rate 1-10 year	.03	.04	-.181**	-.083	-.021	-.330**	-.046	-.281**	-.227**	.170*	.169*	.154*	.833**	.875**	.932**	-						
15. Square turnover rate 10year	.0004	.004	.019	.053	-.053	.086	.119	-.191**	-.125	.143*	-.025	-.076	.292**	.258**	-.001	-.026	-					
16. Turnover rate 10 year	.007	.019	.044	.153*	-.020	.125	.074	-.248**	-.144*	.173*	.020	-.123	.366**	.375**	.088	.086	.880**	-				
17. Firm-specific skill	.66	.20	.000	.135	-.063	.033	-.003	-.003	.043	.012	-.069	-.119	-.033	-.078	-.036	-.056	-.003	-.052	-			
18. General skill	.33	.20	.010	-.138*	.074	-.027	.005	.006	-.041	-.025	.083	.111	.029	.074	.045	.067	-.026	.029	-.933*	-		
19.Communication	3.27	.39	.210**	.041	.144*	.119	-.075	-.058	-.104	-.115	.217**	.010	-.023	-0.34	-.023	-.031	-.004	.039	-.109	.122	-	
20. Innovation	14.86	73.11	.308**	.064	.124	.109	-.027	-.027	-.005	-.065	.090	-.069	.024	-.031	.079	.014	-.021	-.033	-.034	.040	.063	-

Table 2. Negative Binomial Regression Results for Turnover and Innovation

(Hypothesis 1)

Independent Variable	Degree of freedom	Coefficient	Standard error	Wald χ^2	P-value
Constant	1	-12.625	1.3740	84.435	0.000
Firm sales	1	.755	.0703	115.300	0.000
Firm age	1	-.002	.0058	.110	.740
CEO	1	-.070	.1858	.141	.707
Union	1	.156	.2244	.484	.487
Cost strategy	1	.085	.2072	.170	.680
ROA	1	1.440	1.1249	1.639	.200
ROE	1	.439	.4329	1.029	.310
Downsize	1	-.432	.2249	3.692	.055
MA/PHD rate	1	5.328	1.6531	10.387	.001
Hire rate	1	-1.258	.8698	2.093	.148
Square turnover rate	1	104.044	22.9133	20.619	.000**
Turnover rate	1	-13.686	5.1467	7.071	.008**
LR χ^2		130.25			
Prob > χ^2		0.0000			
Pseudo R^2		0.1069			

Notes. n = 201 (firms). * p < .05, ** p < .01

Table 3. Negative Binomial Regression Results for Turnover with Short-Tenure Employee

(Hypothesis 2)

Independent Variable	Degree of freedom	Coefficient	Standard error	Wald χ^2	P-value
Constant	1	-13.057	1.3697	90.865	0.000
Firm sales	1	.770	.0703	119.946	0.000
Firm age	1	.000	.0057	.002	.964
CEO	1	-.081	.1882	.186	.666
Union	1	.186	.2207	.713	.398
Cost strategy	1	-.060	.2088	.081	.775
ROA	1	1.313	1.1067	1.408	.235
ROE	1	.452	.4315	1.097	.295
Downsize	1	-.456	.2247	4.124	.042
MA/PHD rate	1	4.157	1.5407	7.281	.007
Hire rate	1	-1.161	.8614	1.818	.178
Square turnover rate 1-10	1	159.985	34.4368	21.583	.000**
Turnover rate 1-10	1	-13.884	6.2661	4.909	.027*
LR χ^2		139.53			
Prob > χ^2		0.0000			
Pseudo R^2		0.1145			

Notes. n = 201 (firms). † $p < .10$ * $p < .05$, ** $p < .01$

Table 4. Negative Binomial Regression Results for Turnover with Long-Tenure Employee

(Hypothesis 2)

Independent Variable	Degree of freedom	Coefficient	Standard error	Wald χ^2	P-value
Constant	1	-11.792	1.2738	85.691	0.000
Firm sales	1	.699	.0675	107.168	0.000
Firm age	1	-.005	.0059	.668	.414
CEO	1	.193	.1919	1.009	.315
Union	1	-.097	.2207	.192	.661
Cost strategy	1	.522	.2055	6.448	.011
ROA	1	.735	1.2136	.367	.545
ROE	1	-.317	.3866	.673	.412
Downsize	1	-.339	.2314	2.145	.143
MA/PHD rate	1	10.899	1.9265	32.005	.000
Hire rate	1	-1.604	.8467	3.587	.058
Square turnover rate 10yr	1	-913.671	378.2560	5.835	.016*
Turnover rate 10yr	1	30.685	20.4937	2.242	.134
LR χ^2		116.72			
Prob > χ^2		0.0000			
Pseudo R^2		0.0958			

Table 5. Negative Binomial Regression Results for Skill Type *(Hypothesis 3a)*

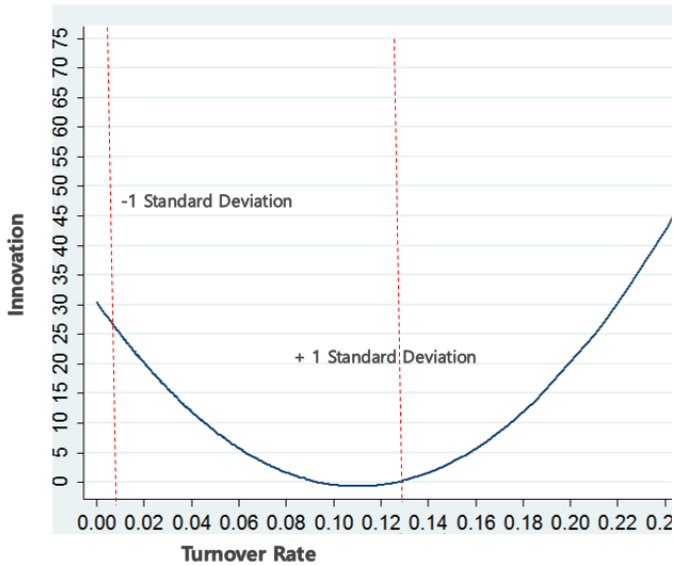
Independent Variable	Degree of freedom	Coefficient	Standard error	Wald χ^2	P-value	Coefficient	Standard error	Wald χ^2	P-value
Constant	1	-14.616	4.1425	12.450	.000	-15.416	4.0574	14.436	.000
Firm sales	1	.752	.0709	112.349	0.000	.751	.0709	112.327	0.000
Firm age	1	-.002	.0058	.162	.688	-.002	.0058	.155	.694
CEO	1	-.081	.1887	.186	.666	-.082	.1887	.189	.664
Union	1	.125	.2257	.307	.579	.128	.2258	.323	.570
Cost strategy	1	.080	.2086	.147	.701	.086	.2086	.168	.681
ROA	1	.984	1.2242	.646	.422	1.080	1.2216	.782	.377
ROE	1	.393	.4288	.842	.359	.406	.4310	.886	.347
Downsize	1	-.433	.2240	3.744	.053	-.430	.2242	3.675	.055
MA/PHD rate	1	5.158	1.6657	9.591	.002	5.201	1.6684	9.718	.002
Hire rate	1	-1.203	.8726	1.900	.168	-1.217	.8720	1.948	.163
Square Turnover rate	1	106.006	23.9221	19.636	.000	105.042	24.0130	19.135	.000
Turnover rate	1	-23.008	10.0494	5.242	.022	-10.222	6.2652	2.662	.103
Skill type – firm specific	1	1.869	4.1708	.201	.654	2.732	4.0523	.455	.500
Skill type- General	1	2.678	4.0565	.436	.509	3.373	4.0272	.702	.402
Interaction Turnover-FS	1	13.926	12.1992	1.303	.254				
Interaction Turnover-GS	1					-10.543	12.4268	.720	.396
LR χ^2		131.52				131.17			
Prob > χ^2		0.000				0.000			
Pseudo R^2		0.1079				0.1076			

Notes. n = 201 (firms). * $p < .05$, ** $p < .01$

Table 6. Negative Binomial Regression Results for Skill Level and Communication *(Hypothesis 3b, 3c)*

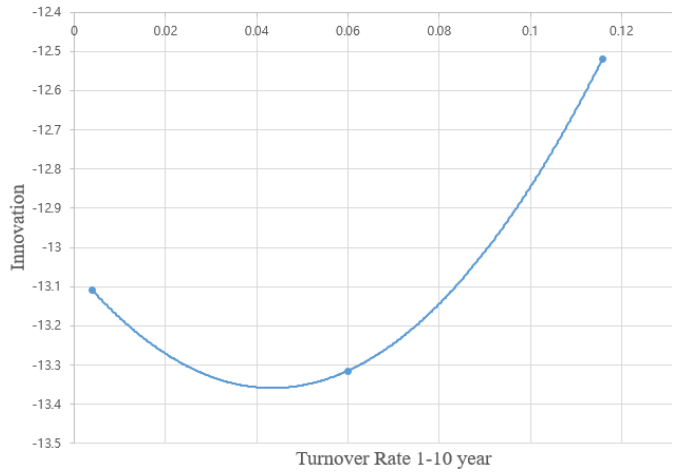
Independent Variable	Degree of freedom	Coefficient	Standard error	Wald χ^2	P-value	Coefficient	Standard error	Wald χ^2	P-value
Constant	1	-13.729	1.4532	89.248	0.000	-17.157	1.8848	82.857	0.000
Firm sales	1	.816	.0747	119.304	0.000	.785	.0713	121.097	0.000
Firm age	1	-.001	.0058	.022	.882	-.002	.0058	.163	.687
CEO	1	-.148	.1873	.627	.428	-.232	.1897	1.499	.221
Union	1	.065	.2278	.081	.776	.060	.2266	.069	.793
Cost strategy	1	.080	.2050	.154	.695	.023	.2045	.012	.912
ROA	1	1.843	1.1294	2.663	.103	.989	1.1460	.744	.388
ROE	1	.541	.4444	1.482	.223	.341	.4147	.675	.411
Downsize	1	-.439	.2230	3.879	.049	-.499	.2245	4.944	.026
MA/PHD rate	1	2.061	1.8429	1.250	.263	4.078	1.6566	6.059	.014
Hire rate	1	-1.393	.8771	2.521	.112	-1.368	.8735	2.454	.117
Square turnover rate	1	59.448	27.1550	4.793	.029	72.286	24.1366	8.969	.003
Turnover rate	1	-10.010	5.3392	3.515	.061	52.795	18.1007	8.507	.004
Communication	1					1.231	.3882	10.062	.002
Interaction Turnover-Skill level	1	61.021	22.2207	7.541	.006				
Interaction Turnover-Communication	1					-18.550	4.8498	14.629	.000
LR χ^2		134.08				137.27			
Prob > χ^2		0.000				0.000			
Pseudo R^2		0.1100				0.1126			

Notes. n = 196 (firms). * $p < .05$, ** $p < .01$ / n = 201 (firms-communication)

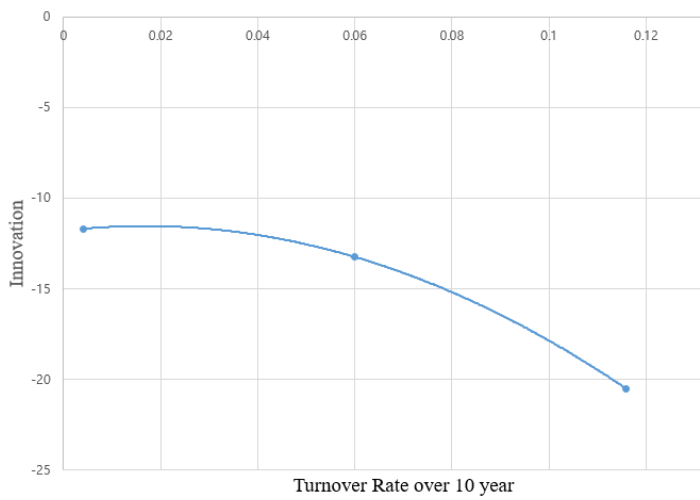


<Figure 2>

Hypothesis 1 was statistically significant but to check for the signs of curvilinear relationship between turnover rate and innovation figure 2 was drawn. Normally when viewing regression results the range is from minus one standard deviation to plus one standard deviation from the mean. But when limited to such boundary the full curvilinear relationship can't be viewed the whole range for turnover rate was shown. Figure shows that turnover is harmful for a firm's innovative performance. Yet after reaching a certain point it shows that a high level of turnover rate can actually benefit a firm's innovative performance.



<Figure 3>

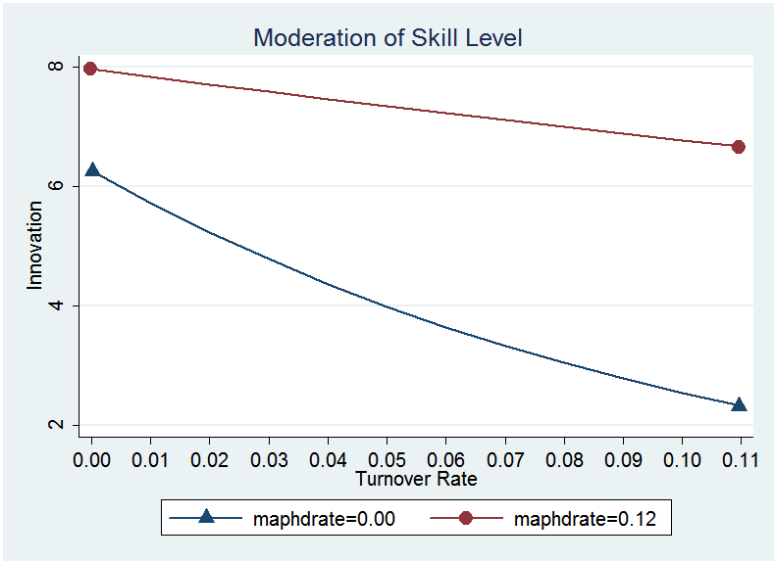


<Figure 4>

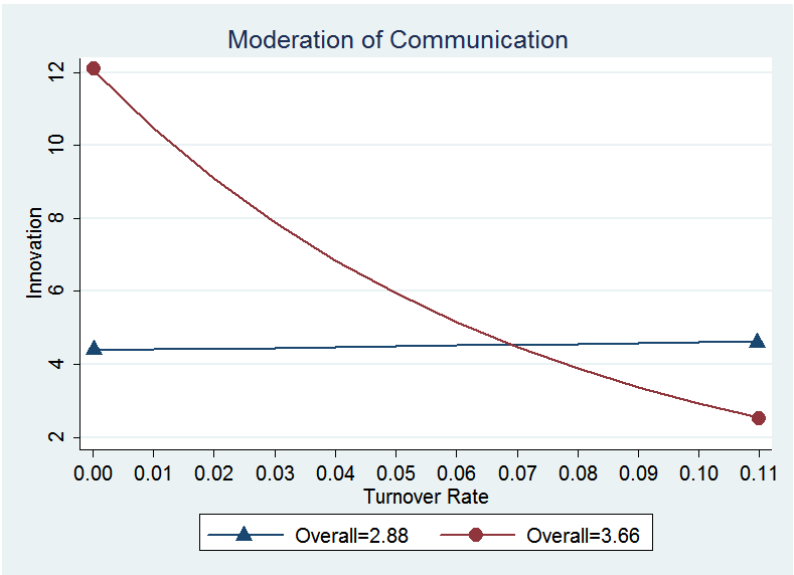
When testing hypothesis 2 square turnover rates were significant for both short and long tenure employees who left the organization. To compare with hypothesis 1, both figures were only drawn from minus one standard deviation to

plus one standard deviation like figure 2. In the case for turnover rate which employees ranged from 1 to under 10 year of tenure it negatively affected a firm's innovative performance while after a certain it showed that turnover actually benefited it. As for turnover rate of individuals who had more than 10 years of tenure in the organization it negatively affected a firm's innovative performance as expected. Therefore, hypothesis 2 has been partially supported.

Figures 5 and 6 show the moderating effects of the contextual variables: skill level and communication. It shows that when the overall skill level within the organization is high the negative influence of turnover on innovative performance is weaker compared to organization with lower skill levels. Moderation of communication on the main relationship is similar but after passing a certain point it has shown that too much communication can actually be more harmful to firm's innovative performance.



<Figure 5>



<Figure 6>

V. Discussion

This study contributes to both the turnover and innovation literature by providing an empirical testing of the link between turnover and innovation. There have been very few researches regarding the relationship between turnover and innovation(Cohen & Klepper, 1996; Guidice et al., 2009), this paper can perhaps help shed some light on the connection and provide that consideration of contextual factors are also needed in the future. Based on human capital theory (Strober, 1990) and social capital theory (Dess & Shaw, 2001) it was explained turnover leads to losses of such capital for organizations and negatively affects their performances. Assuming that turnover effects would also occur likewise similar to how it affects other performance factors did not appear as suggested.

Results show that there is a negative relationship between turnover and innovation but square turnover rates suggested there is a curvilinear relationship between turnover and innovation, which has been suggested in previous research (Guidice et al., 2009). Such results show that turnover and innovation are not unrelated but have a positive relationship in certain contexts. Either by reducing turnover or encouraging high turnover rate can possibly send a message throughout the organization of what they are trying to do. Through sending a clear message about the focus of the company it will allow employees to understand vision of their organization and can encourage members to focus and allow performance levels not

to drop. In an additional analysis using 3-year average of turnover rates it showed that turnover has a positive influence on a firm's performance. Although unexpected unlike other turnover negative consequences, it appears to suggest that for a firm to be innovative a certain amount of turnover is continuously needed in organizations.

For firms to be innovative they need to acquire diverse knowledge and ideas and successfully convert them into reality (Sung & Choi, 2012). To ensure an innovative performance within organizations the very basic step is to be able to draw on different ideas that can be presented by employee within the firms. A possible explanation why turnover is positive for innovative performance is that employees have become homogeneous overtime in general and such homogeneity in groups doesn't help an organization's innovative performance.

According to Schneider (1987)'s Attraction-Selection-Attrition model individuals become homogenous over time. It has been suggested that homogeneity in organizations may benefit organizations in stable environment(SCHWENK, 1996). Firm's trying to achieve innovative performance is rather in a dynamic environment and it would be beneficial if employees had heterogeneous thinking rather than a homogeneous one. It can possibly be explained that a turnover occurs in a homogeneous group which will not lead to losses of any forms of capital. After

turnover firms have shown to hire similar percentages back into their organization, which can be interpreted as an influx of new capital and different ideas. As a result of these consequences the positive effect of turnover on innovation can be possibly explained. Results regarding the positive impact of individual's turnover who has a 1year to under 10year tenure can also be explained likewise.

Other results showed that high levels of communication and R&D skill level within a firm showed to moderate the negative affect of turnover on a firm's innovative performance. Having either high communication levels and skill level within an organization allows the loss of turnover effect's to be as low as possible. As discussed turnover results in all types of losses for the organization and has been continuously shown that it negatively affects performance. Although the human and social capital withheld by the individuals who turned over leads not only to losses for the organization, when others remaining can fill in the gap created its effects are not so serious. However in the case for moderation of communication level it has shown that after a certain point a firm's innovative performance gets worse than that of a firm with low levels of communication. It might be due to the fact that increases in turnover inside an organization also causes working partners within teams and projects to disappear making it difficult to continue with the ongoing project with the reduced number of employee. Results showed somewhat differently from what was hypothesized this can provide managers with practical

implications. Threat of turnover is always imminent inside organizations and losing employees who are highly skilled can not only lead to losses but benefit the organization in some cases. For either very low rates of turnover or high rates of turnover can send a message throughout the organization and can deter employees from getting confused and focus on their work. Also high level of communication levels and high skill level can allow all employees to even know very core aspects and be able to fill in the gap due to turnover. By doing so firms can reduce the negative influence of turnover.

Limitations and future research

Although this study provides contribution for practical and theoretical implication it has limitations that need to be addressed. First to test the hypotheses the data sample used was quite limited, because it could not clearly distinguish voluntary turnover. Although using some control variables and under the Korean firm context it helped to ensure that turnover that occurred was voluntary, it is not clear whether truly all the turnover was voluntary. Secondly the dataset was only limited to the manufacturing sector and can't be generalized to other industries. If the study used other firms from other industry sector that has relationship with innovation its meaning would be more significant. Also the dataset only used Korean firms as sample. It has been shown in diverse researches that cultural

contexts play a significant role so it is difficult to generalize the results. Since there are very few researches discussing the relationship between turnover and innovation and general it is difficult to trust these results unless they were tested in other countries as well. Lastly the dataset was a cross-sectional one. To test the study as a longitudinal research a firm's patent data was used after the year of survey was collected, but patents acquired by firm's may differ from industry. So in future researches it would be ideal to select a couple of industry sectors that an average year can be calculated to view the innovative performance of organizations.

VI. Conclusion

Despite the deep researches of both turnover and innovation there has been too few researches trying to discover the link it. It still remains unclear how turnover affects a firm's innovative performance. In this research it showed that turnover in some contexts can be harmful and organizations should be aware of it to avoid negative consequences. Yet it is unclear whether turnover is truly positive for innovative performance. Future researches should try to discover in what industry or what contextual factors within organizations help explain the relationship between turnover and innovation.

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요약 (국문초록)

이직과 혁신의 관계: 기술 종류, 기술 수준과 커뮤니케이션의 조절 효과

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본 연구는 조직에서 발생하는 이직이 기업의 혁신성과에 어떤 영향을 미치는지 보고자 하는 연구다. 이직 및 혁신과 관련한 연구들은 각각 활발하게 이루어져 왔지만 이 둘간의 관계를 보고자 하는 연구는 이론적, 실증적으로 부족하다. 그나마 있는 연구들의 결과에서는 일관된 합의가 존재하지 않으며 이제는 혁신성과도 기업들에게 중요해졌기 때문에 연구할 필요성이 존재한다. 기존 이직관련 연구들은 인적자본이론과 사회적자본이론을 바탕으로 기업에서 이직이 발생할 경우 기업의 혁신성과에 부정적인 효과를 미칠것이라고 제시한다. 또한 조직 내에서 전체적인 이직률뿐만이 아닌 누구의 이직이 더 조직의

성과에 영향을 미치는지를 살펴 볼 필요성이 대두되고 있다. 근속연수는 개인이 지니고 있는 지식과 경험의 지표로 볼 수 있기에 이직자들의 근속연수에 따라서 조직 혁신성과에 미치는 영향이 차이가 있는지 보고자한다. 추가적으로 이직과 혁신간의 관계에서 기업의 어떠한 상황적 요소가 조절효과를 가지게 되는지 살펴본다. 인적자본기업패널 자료를 사용하여 음이항 회귀분석을 한 결과 이직이 기업의 혁신성과에 부적인 영향을 갖는것으로 나타났다. 하지만 장기 근속자에 비해 다른 근속자들의 이직이 적거나 매우 많이 발생하면 오히려 혁신에 긍정적인 영향을 보여주었다. 조절효과로 조직 내 기술수준, 기술종류, 커뮤니케이션을 검사해본 결과 조직의 기술수준과 커뮤니케이션이 높을수록 이직의 부정적효과가 감소하는 결과를 볼 수 있었다. 따라서 본 논문은 조직내 상황적 맥락에 따라 부정적인 효과가 감소할 수 있다는 점을 시사한다.

주요어: 이직, 혁신성과, 인적자본이론, 사회적자본이론, 근속연수

학번: 2015-20670